

Appl. No. 09/538,700
Amtd. Dated July 29, 2003
Reply to Office Action of June 2, 2003

REMARKS/ARGUMENTS

Claims 1-14 were pending in this case prior to this response. Independent claims 1 and 10 are amended to clarify that the methods utilize first and second array controllers at the site of the local data storage array to provide redundancy along with remote storage at a remote storage system which is not shown by the cited art.

Support for these amendments can be found in the originally filed claims 1 and 10 and at least in Figures 2 and 3 a and supporting text. No new matter is added by the amendments, and claims 1-14 remain for consideration by the Examiner.

Rejections under 35 U.S.C. § 102

In the June 2, 2003 Office Action, claims 1-14 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,544,347 ("Yanai"). This rejection is traversed based on the claim amendments and following remarks.

Claim 1 is directed toward a method of remotely backing up data written at a local data storage system using dual local array controllers as well as a remote storage system. Specifically, claim 1 calls for "providing a first array controller and a second array controller coupled to each other and also coupled between the host computer and the array" at a first site and storing "on a log unit in primary cache memory in the first array controller" data and associated commands for write transactions. Further, the method calls for "mirroring the primary cache in backup cache memory in the second array controller at the first site."

In contrast, Yanai in Fig. 1, col. 7, lines 7-11 fails to teach the use of two local array controllers with a first local controller storing write transaction data in a cache which is mirrored in a second local

controller. Yanai in Fig. 1 shows a single controller 16 at the primary or local data storage 14 at a first site and a second controller 44 at a remote site in secondary data storage system 46. Yanai fails to teach a second, backup controller at the primary data storage system 14. Further, the Office Action cited Yanai at col. 7, lines 7-11 for teaching “mirroring” however at this citation Yanai merely states that a log file should be kept by the primary data storage system and that such a log file may be kept “in the cache memory of the primary or the secondary data storage system controller.” Mirroring of the log file is not required but instead Yanai teaches away by stating that the log file may be kept in either cache (not both) and certainly, Yanai fails to teach using two array controllers at the primary storage to maintain a written transaction cache that is mirrored in the controllers’ caches. Hence, for at least this reason, claim 1 is allowable over Yanai because Yanai fails to teach (or even suggest) each and every element of the claim.

Further, claim 1 calls for “re-playing the data on the log unit by performing: for each entry in the log unit mirrored in the backup cache in the second array controller: reading the data from the backup cache for each said transaction in the log unit; and writing the data to the remote storage system in transaction order.” Each feature of this claim element is not taught by Yanai. Specifically, the Office Action cites col. 7 lines 62-64 and col. 8 lines 33-35 for teaching this element. However, at the col. 7 citation, Yanai states “once the secondary data storage system has written the data to the secondary data storage device, the secondary data storage write pending indicator bit 106 will be reset” and at the col. 8 citation, Yanai merely states that as a background operation that “the drives re-synchronize.” These combined teachings of Yanai do not anticipate the limitations of “for each entry in the log unit mirrored in the backup cache in the second array controller...writing the data to the remote storage system in

transaction order." For this additional reason, claim 1 is allowable over Yanai.

Claims 2-9 depend from claim 1 and are believed allowable for at least the reasons for allowing claim 1. Further, claim 3 calls for "writing the data includes performing a transaction-order merging of the data on the log unit with the data previously stored on the remote storage system..." Yanai is again cited at col. 8, lines 33-35 for teaching this limitation, but Yanai merely states that the drives "re-synchronize" but does not teach the specific limitation of claim 3 and specifically "transaction-order merging" which is not required for re-synchronization. Claim 7 calls for the second array controller to communicate with the first array controller to determine when the first array controller fails. As claimed the first and second array controllers are at a first site and are linked to a remote data storage system. The Office Action cites Yanai at Figure 1 for teaching the limitation of claim 7, but as shown in Figure 1, Yanai does not teach 2 controllers at the primary data storage system 14 so fails to anticipate claim 7. Claims 3 and 7 are believed allowable for these additional reasons.

Independent claim 10 includes similar language to that of claim 1 and the arguments provided for allowing claim 1 are applicable to claim 10. More particularly, claim 10 calls for "storing the data for each write transaction from the host computer in mirrored cache memory in both the first array controller and the second array controller, the first and second array controllers being located at a site remote to a site of the remote storage system." As discussed with regard to claim 1, Yanai in Figure 1 and elsewhere fails to show the use of two array controllers at a single site. Additionally, Yanai fails to teach cache memory that is mirrored in the two controllers at the single site.

Appl. No. 09/538,700
Amdt. Dated July 29, 2003
Reply to Office Action of June 2, 2003

Because at least these elements of claim 10 are not shown or suggested, claim 10 is allowable over Yanai.

Claim 10 also includes the limitation of "storing command information including the LBN extent associated with the data in a log in mirrored cache memory." The Office Action cites Figure 1 of Yanai and col. 7 lines 7-11 for teaching this limitation but Yanai at this point says pending data must be maintained in a log file in the primary or secondary data storage systems. There is no discussion of storing the "LBN extent." Each and every element is not shown so Yanai fails to anticipate claim 10.

Further, claim 10 calls for "merging the data, stored on said log, with the backup copy in the remote storage system, in response to commands issued by the second array controller, by using the command information stored in the log to write the data ...in the order in which each said write transaction originally occurred." Yanai does not teach a second array controller as defined in claim 10. Additionally, the Office Action cites Yanai at Fig. 2 and col. 7 lines 7-11 and 62-62, col. 8 lines 33-35 for teaching this limitation of claim 10. Yanai appears to teach a log for tracking pending writes but does not detail how "the drives re-synchronize." Hence, Yanai does not teach "using the command information stored in the log to write the data...in the order in which each said write transaction originally occurred."

Claims 11-14 depend from claim 10 and are believed allowable for the reasons for allowing claim 10.

Appl. No. 09/538,700
Amdt. Dated July 29, 2003
Reply to Office Action of June 2, 2003

Conclusion

No fee is believed due for this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 08-2025.

Applicants respectfully request that a timely Notice of Allowance be issued in this case.

Respectfully submitted,

7/31, 2003


Peter J. Meza, Reg. No. 32,920
(719) 448-5906 Tel
(719) 448-5922 Fax